REMARKS

Applicants have amended their specification to indicate that reference character 13 denotes a DC power supply in Fig. 2. It is respectfully submitted that as of the filing date of the above-identified application, one of ordinary skill in the art would have known that the reference character 13 in Fig. 2 denotes a DC power supply (see, for example, the structure represented by reference character 51 in Fig. 3 in the applied European Patent Application No. EP 709 877 to Saito, et al., and the corresponding description in column 4, lines 50-59 thereof); and, accordingly, it is respectfully submitted that this amendment of the specification does not add new matter to the application.

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have cancelled original claims 1 and 2 without prejudice or disclaimer, and have added new claims 3-7 to the application. Of these newly added claims, claims 3 and 7 are independent claims, and correspond respectively to previously examined claims 1 and 2. Claim 3 differs from claim 1 in reciting, in a "wherein" clause, that the semiconductor substrate is etched using plasmas obtained from each introduced treating gas in each step, while the treating gas (b) (that is, the treating gas for decomposing and removing etching products) removes etching products retained in the etching treatment room without conducting a separate cleaning step; and in reciting that the monitoring means is controlled so as to stop each plasma discharge automatically at a time the monitored value reaches a set value. New independent claim 7 differs from previously considered claim 2, in adding the final "wherein" clause (that is, that the gas introducing means introduces different gas compositions

in each of at least two steps, at least one of the gas compositions being a gas capable of decomposing and vaporizing etching products, and the semiconductor substrate being etched by using plasmas obtained from the different gas compositions of the at least two steps, etching products produced by a previous etching treatment being removed without conducting a separate cleaning step.

In connection with claims 3 and 7, note, for example, pages 3, 4, 6, 9, 13, 15 and 23, of Applicants' specification.

In addition to claims 3 and 7, Applicants are adding new claims 4-6 to the application. Claims 4 and 5, each dependent on claim 3, respectively recites that the gas introducing means includes a source of the treating gas for decomposing and removing etching products and a source of the treating gas for etching; and recites that the apparatus further includes an electrostatic adsorption device to hold a semiconductor substrate on the substrate stage. And claim 6, dependent on claim 5, recites that the apparatus is adapted to discharge charges stored between the substrate stage and a semiconductor substrate placed thereon, with the gas introducing means introducing the treatment gas for decomposing and removing etching products, into the etching treatment room, when the charges are discharged.

In connection with claims 4-6, note, for example, pages 4, 9, 10 and 21 of Applicants' specification.

The objection to the drawings as set forth in the first paragraph on page 2 of the Office Action mailed September 10, 2004, is noted. In view of the amendment to the paragraph bridging pages 15 and 16 of Applicants' specification, to provide a description for reference character 13 in Fig. 2, it is respectfully submitted that this objection to the drawings is moot.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed September 10, 2004, that is, the teachings of U.S. Patent No. 5,846,373 to Pirkle, et al., and European Patent Application No. EP 0 709 877 to Saito, et al., under the provisions of 35 USC §102 and 35 USC §103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a plasma etching treatment apparatus as in the present claims, including, inter alia, wherein, in connection with the gas introducing means, the semiconductor substrate is etched using plasmas obtained from each introduced treating gas in each step, while the treating gas (b) removes etching products retained in the etching treatment room without conducting a separate cleaning step; and, moreover, the monitoring means is controlled so as to stop each plasma discharge automatically at a time the monitored value reaches a set value. See claim 3.

In addition, it is respectfully submitted that these references would have neither disclosed nor would have suggested such a plasma etching treatment apparatus as in the present claims, having the recited gas introducing means, and wherein this gas introducing means introduces different gas compositions in each step of the at least two steps, at least one of the gas compositions being a gas capable of decomposing and vaporizing etching products, and the semiconductor substrate being etched by using plasmas obtained from the different gas compositions of the at least two steps, etching products produced by a previous

etching treatment being removed without conducting a separate cleaning step. See claim 7.

To emphasize, and in connection with each of claims 3 and 8, etching is performed in each step, and etching products produced by a previous etching treatment are removed without conducting a separate cleaning step.

Moreover, it is respectfully submitted that the teachings of the applied prior art would have neither disclosed nor would have suggested such apparatus as in the present claims, having features as discussed previously in connection with claim 3, and, moreover, wherein the gas introducing means includes a source of the treating gas for decomposing and removing etching products and a source of the treating gas for etching (see claim 4); and/or wherein the apparatus further includes an electrostatic adsorption device to hold a substrate on the substrate stage (see claim 5), particularly wherein the apparatus is adapted to discharge charges stored between the substrate stage and a semiconductor substrate placed thereon, with the gas introducing means introducing the treating gas for decomposing and removing etching products, into the etching treatment room, when the charges are discharged (see claim 6).

The invention as claimed in the above-identified application relates to apparatus for effectively removing etching products retained in a treatment apparatus, providing a cleaning effect of the apparatus, without disadvantageously effecting productivity. This apparatus is especially useful in connection with recent semiconductors having higher integration, wherein circuit patterns become finer and finer to make required processing dimensional accuracy severer; and wherein, under

such circumstances, reproducibility of the processed device becomes even more important.

In such recent fine devices, it becomes more important to remove etching products (contaminants) retained in the processing chamber, these etching products being an important cause of defective semiconductor products. Various techniques have been proposed to remove such etching products, as described on pages 2 and 3 of Applicants' specification; however, such proposed techniques either do not address the problem of shift of etching ability due to retention of deposited material on the apparatus, or require substantial "downtime" (a time when the apparatus is stopped from processing substrates), which disadvantageously effects productivity. See the last paragraph on page 2, and the paragraph bridging pages 2 and 3 of Applicants' specification.

Against this background, Applicants provide etching treatment apparatus which removes etching products so as to achieve a removal of reaction products (contaminants) in the treating chamber such that the contaminant level does not exceed a predetermined amount, so that reproducibility of the etching shape is retained, while avoiding the above-mentioned "downtime". Applicants have found that by utilizing apparatus including the gas introducing means as in the present claims, wherein the semiconductor substrate is etched using plasmas obtained from each introduced treating gas in each step, while the treating gas (b) removes etching products retained in the etching treatment room without conducting a separate cleaning step, the objectives according to the present invention are achieved; and, in particular, avoidance of deposition on chamber walls are avoided such that

reproducibility of etching shape is retained, without disadvantageous "downtime" which reduces productivity.

In addition, Applicants have found that, in combination with the gas introducing means, through use of the monitoring means as in the present claims, treatment time can be kept to a minimum, making more efficient the processing.

Saito, et al. discloses a plasma processing method and apparatus suitable for etching a wafer while holding the same on an electrode by electrostatic force, and using hydrogen bromide as an etching gas. This patent document discloses, according to one aspect thereof, that after completion of etching of the wafer having the same wafer as electrostatically chucked on the electrode, O_2 gas instead of the etching gas is introduced into the chamber to generate a plasma of O_2 gas, whereby not only the residual electric charge on the wafer resulting from the electrostatic attraction can be deelectrified but also cleaning of the interior of the chamber can be conducted at the same time by causing C and H which are the main components of the reaction product deposited inside the chamber to react with O_2 and to be removed. See column 2, lines 14-31. Note also column 3, lines 15-27 and 37-43; and column 4, lines 3-11.

It is respectfully submitted that Saito, et al. discloses a cleaning treatment which is conducted separately from the etching treatment. That is, the cleaning with the O_2 plasma is not an etching treatment. It is respectfully submitted that this reference would have neither disclosed nor would have suggested, and in fact would have taught away from, the presently claimed apparatus, including wherein the gas introducing means introduces different gas compositions in each step of at least two steps, at least one of the compositions being a gas capable of decomposing and

vaporizing etching products; and the semiconductor substrate being etched by using plasmas obtained from the different gas compositions of the at least two steps, with etching products produced by a previous etching treatment being removed without conducting a separate cleaning step.

That is, while the present invention includes gas introducing means wherein the substrate is etched using plasmas obtained from the different gas compositions at the various steps, so that the apparatus is utilized without conducting a separate cleaning step, Saito, et al. requires a separate cleaning step using the O_2 gas therein.

Pirkle, et al. discloses methods and arrangements for monitoring silicon dioxide deposition and in-situ cleaning process endpoints in plasma chambers, wherein an SiO_2 deposition is performed on a semiconductor substrate; and an in-situ cleaning process is performed on the plasma chamber, subsequent to the SiO_2 deposition, the in-situ cleaning process including steps of generating a fluorine-containing etching plasma in the plasma chamber so that the etching plasma reacts with SiO_2 in the plasma chamber to form a plurality of reaction products; filtering light emissions from the plasma chamber with a wavelength selective element so that one of the reaction products having a characteristic wavelength proximate the peak transmission of the wavelength selective element is transmitted through the wavelength selective element, monitoring, with a photodetector, emission intensity of light emitted by one of the reaction products; measuring voltage output from the photodetector, the voltage output being proportional to the amount of the reaction product in the etching plasma; and stopping generation of the etching plasma when voltage measurements decrease to a substantially steady state value. Note

column 2, lines 22-56. See also column 3, lines 26-51, in connection with the described apparatus. Note also column 4, lines 41-45.

Even assuming, arguendo, that the teachings of Saito, et al. and Pirkle, et al. were properly combinable, it is respectfully submitted that the combined teachings of these references would have neither disclosed nor would have suggested the gas introducing means, and particularly wherein the semiconductor substrate is etched using plasmas obtained from each introduced treating gas in each step, while the treating gas (b) removes etching products retained in the etching treatment room without conducting a separate cleaning step; and/or control of the monitoring means so as to stop each plasma discharge automatically at the recited time, as in claim 3.

It is noted that Pirkle, et al. uses a wavelength selective device for monitoring the deposition and cleaning process; but it is respectfully submitted that this reference does not disclose, nor would have suggested, either by itself or in combination with the teachings of Saito, et al., controlling the monitoring means so as to stop each plasma discharge automatically as in the present claims.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application, are respectfully requested.

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Respectfully submitted,

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